Corns in sight hounds

Greyhounds, whippets and lurchers

All you need to know!

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What is a corn?

- A focal area of hyperkeratisation on the pads
- A localized area of hard pad made of keratin

- What is keratin?
- Structural fibrous protein in the skin
  - Nails
  - Horns scales etc

What do corns look like?

- Ill defined broad area with loss of pigment

- Typical corn
  - Circular defines area – often with a black central core area

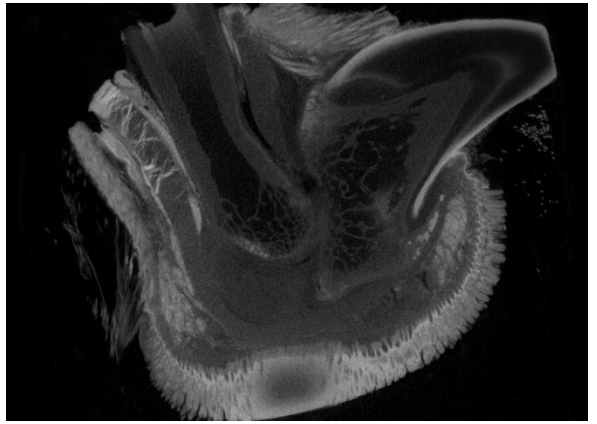
- Large area of fibrous pad
  - Usually at the side of the pad and not wearing

How common are corns?

- Occurrence from 2 surveys of medical records in pet greyhounds:
  - 5.9% and 2.4% of consultations
- Most common dermatological condition
- Almost certainly under diagnosed!
  - Advanced imaging can often find other inconsequential problems!

Why are corns important?

- It is by far the commonest cause of lameness in the sight hound breeds
- The lameness can be very severe – not weight bearing
- It often affects more than one pad in either the same or a different foot
- Compare it to having a stone in your shoe!!



Why does keratin proliferate?

- This is a protective response to injury: sun burn, cuts, pressure cushioning

- Man:
  - A CALLUS is response to repeated contact or pressure trauma
    - Tight shoes (friction callus)
  - A CORN is a discrete callus with a central conical core of keratin
    - Insufficient soft tissue between the skin and bone
  - Foot deformities
    - Hammer toe

Clinical signs

- Lameness
  - Mild to non-weightbearing
  - Worse on hard ground
    - Seek out grass etc
  - May hold up foot

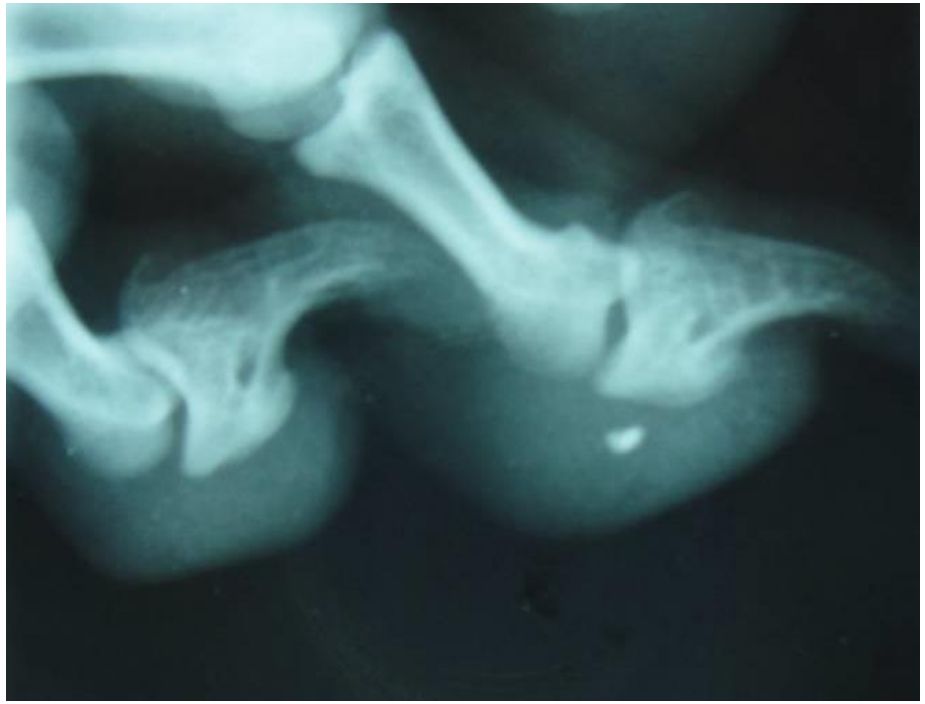
- Depression
  - Reluctant to walk far
  - After SDFT owners report they have their dog back to its happy self

Diagnosis

- Observation
  - See obvious proud corn
  - Little to see. Wet the area.
  - Photograph the pad!
  - Small black spot

- Palpation
  - Orthogonal focal pressure – pain
  - Medial-lateral thickening

- Differential diagnosis – Foreign body
  - Discharging sinus/ulcer
  - X-ray



Other corns, calluses or keratomas

The Journey of 40+ years

- Historical treatment was either:
  - Conservative management
  - Ointments, balms etc
  - Hulling
  - Excision of the corn
  - Toe amputation if it recurred.

Journal of Small Animal Practice 2010

Corns in dogs; signalment, possible aetiology and response to surgical treatment

- **Summary:**

  - A review of 40 corns in 30 dogs
  - Approx 90% occurred in the central toes
    - Main weightbearing toes
  - Approx 90% occurred in the forelimbs
    - Main weightbearing limbs

Journal of Small Animal Practice 2010

Corns in dogs; signalment, possible aetiology and response to surgical treatment

- **Summary:**

  - 52% of excised corns recurred in 12 months and 74% had recurred between 1 and 5 years

  - 2 corns treated by amputation of last joint but with pad repositioned disappeared!

  - Multiple corns occurred in 37% dogs
    - At initial presentation or developed after surgery

Historic theories as to the cause

- **Viruses**
  - Papilloma virus.
    - Common in dogs causes warts
    - Causes verrucas in man
  - Several published studies have found no evidence

- **Foreign body penetration**
  - Glass, grit, thorns
  - 40 corns (*Guilliard*) – none found
  - 1000 corns(*Doughty*) – none found
  - 4.5% had secondary penetration
    - Plant material

Mechanical theory

- **In Man**
  - Corns and calluses
    - Tight-fitting shoes
  - Anatomical deformities:
    - Hammer toe

- **In sight hounds**
  - Genetics
  - Foreign body scar tissue in pad
  - Predominance of the main weight-bearing toes
    - Front central toes
  - Anatomical deformities

Anatomical deformities:

alters the loading area of the pads

- 40% had abnormalities (*Guilliard 2010*)
- Most were insignificant except:
  - Distal amputations (stump pressure)
  - P1/2 hyperflexion (tight knucle)
    - Naturally seen in whippets
    - Damage to SDF tendon
  - P3 fracture

SDFT injury

- Common in racing greyhounds
  - Left fore toe 5
  - Right fore toe 2
  - From leaning into the bends and overloading the tendons
  - Treated by surgery
  - Raced ok afterwards!!

Previous surgery to hock

- Extreme flexion of D3 and D4
- From damage to superficial digital flexor tendon

Other causes of corns from pad lesions

- Sebaceous cysts
- Adventitious bursa
- Tumours

Other breeds and pads

- Not common but same causal factors.
  - Border collie

- Corns in large pads (metacarpal and metatarsal)
  - From foreign body penetration

Mechanical theory evidence

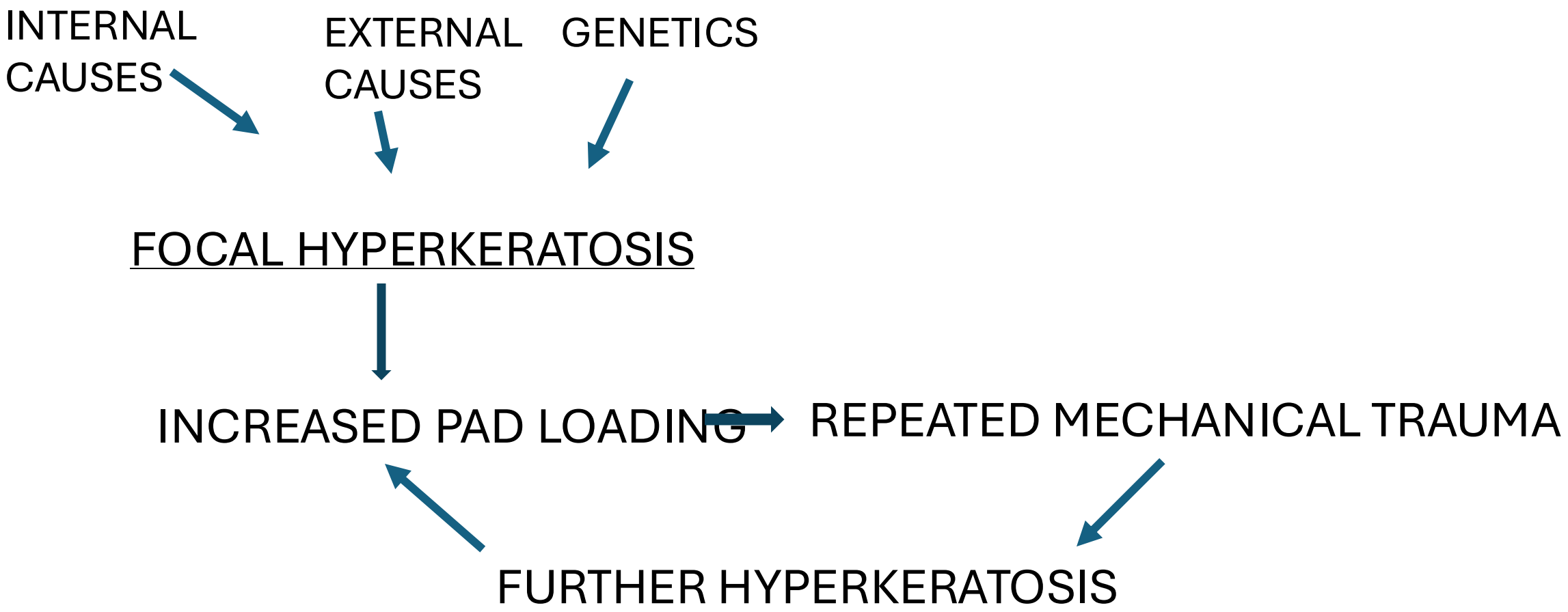
- 90% in main weight bearing pads
- Corn regression from:
  - Silicone gel implants (*Swaim 2004*)
  - Revision surgery on distal amputations (2 cases) (*Guilliard 2010*)

- In theory if the pad is unloaded then the corn will exfoliate (grow out)

Why Sight Hounds - Genetics

- Less cushioning than other breeds:
  - Pads have smaller surface area
    - Proportionally more loading to labs
  - Thinner in depth
  - Less soft tissue under the pads
- Over-heating adaptation
  - Thinner skin
  - Very little fat
  - Short thin coat

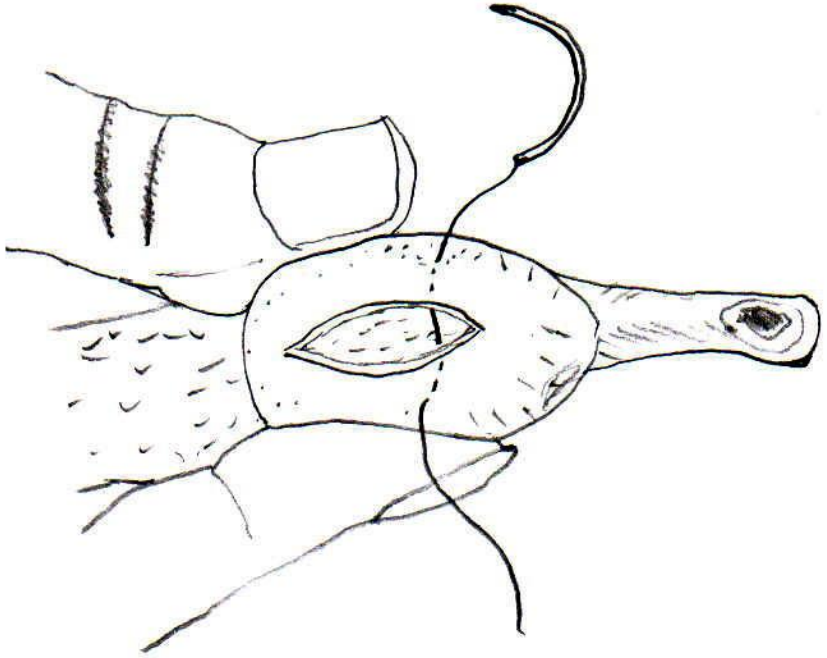
CORNS: THE THEORY OF EVERYTHING!



Historic treatments

- **Topical ointments**
- **Hulling:**
  - Digging out corn
  - Incomplete removal
  - Temporary relief
- **Complete excision:**
  - 50% recur within a year *(Guilliard 2010)*

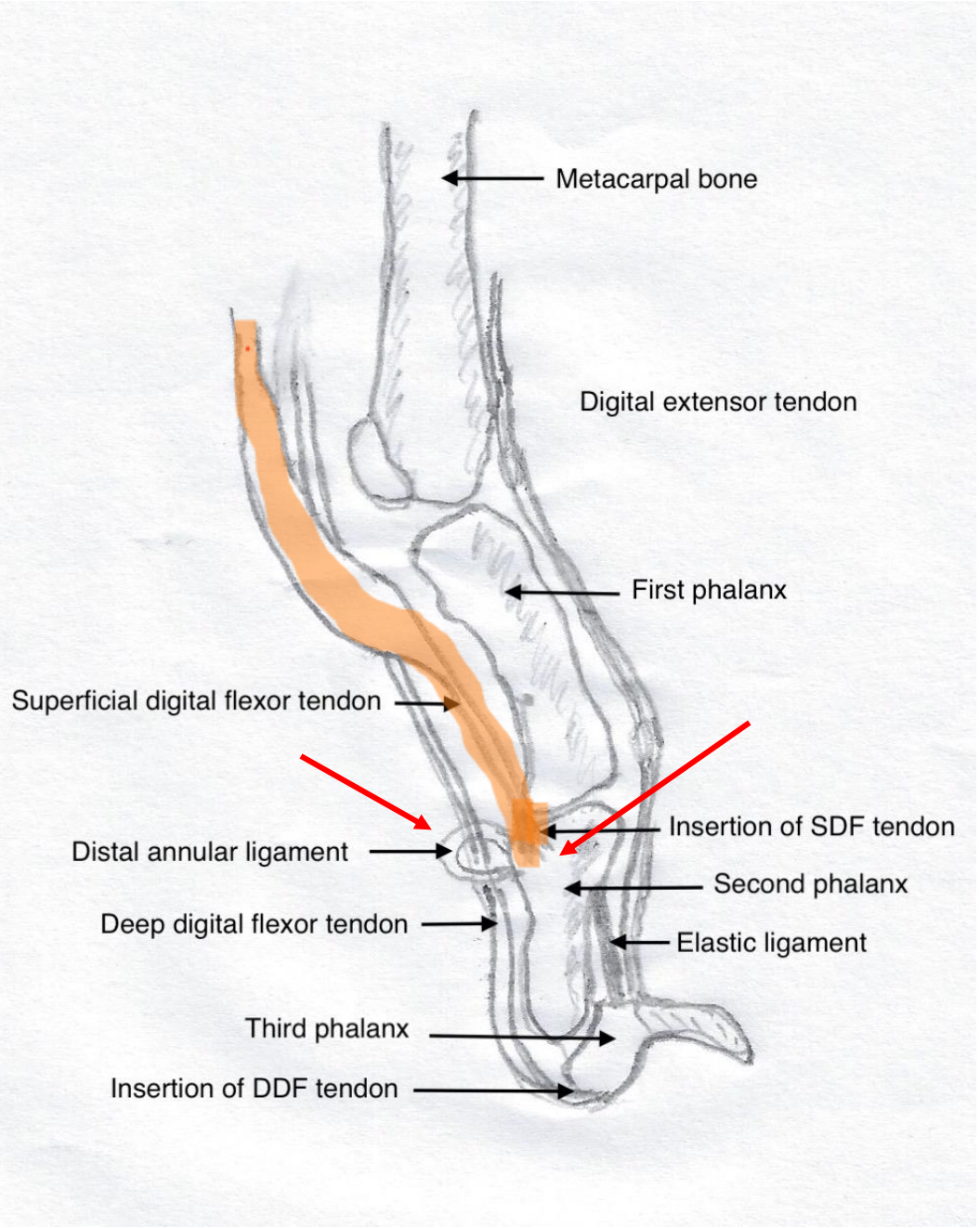
- *Primary cause has not been addressed*



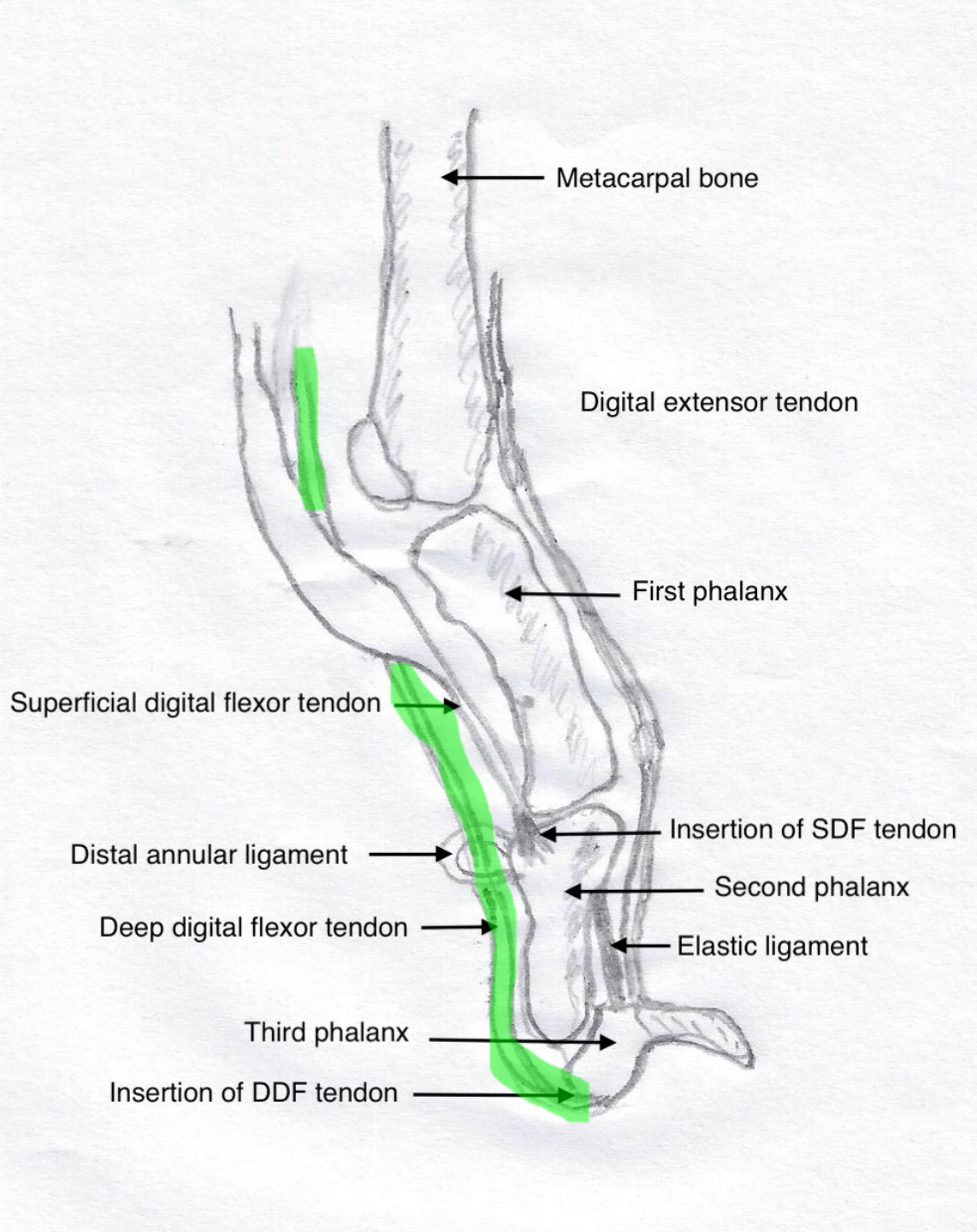
Anatomy

Superficial digital flexor tendon

Distal annular ligament prevent complete collapse



Anatomy
Deep digital flexor tendon



The Journey

First tenotomy in June 2018!

- SDFT and DDFT cut at P1
  - Incision 2mm distal to metacarpal pad

Photo courtesy of Dr Kristy Broaddus

Full tenotomy at P1

- Nail sticks up
  - Aesthetically not nice
- Works well but needs support of adjacent digits
  - Not for missing digit
  - Not for more than one digit
  - Second digit SDFT

Superficial digital flexor tendonectomy SFT

- Originally performed with a full tenotomy on adjacent digit
- Originally a tenotomy
    - Incidences of corn recurrence
    - Tendon rejoining
- Developed into SDF tendonectomy
    - Removal of 1cm + of tendon

SDF Tendonectomy

Black arrows are tendons. White arrow vein

SDFT surgical technique

- **Aftercare**
  - Pressure dressing removed after 24 hours
  - Exercise on lead for 10 days

Short term outcome

(Guilliard & Doughty. 2021 Aust Vet Practit)

100 dogs with 161 corns

Combined S + DDF tenotomy (full tenotomy) – 113 corns

SDF tenotomy – 48 corns

The corns were not treated

At 8 weeks 95% corns not present

	Combined (S+DDF) tenotomy	SDF tenotomy
Improvement at 7 days*		
None	0 (0%)	0 (0%)
Slight	1 (1%)	2 (6%)
Moderate	11 (13%)	12 (36%)
Marked	70 (85%)	19 (58%)
Lameness at 8 weeks**		
Severe	0 (0%)	3 (9%)
Moderate	0 (0%)	0 (0%)
Slight	13 (16%)	6 (18%)
None	70 (84%)	24 (73%)

Medium term outcome

Table 5. Long term outcomes of tenotomies to treat corns (54 surgical sessions)

	Combined (S+DDF) tenotomy	SDF tenotomy
Lameness evaluated from 6 to 9 months (n=24)		
Severe	-	7 (29%)*
Moderate	-	0 (0%)
Slight	-	2 (8%)
None	-	15 (63%)
Lameness at 1 year (n=30)		
Severe	0 (0%)	-
Moderate	1 (3%)	-
Slight	6 (20%)	-
None	23 (77%)	-

- S+DDF tenotomy at 1 year (n = 30)
  - 96% slight or no lameness
- SDF tenotomy (6 to 9 months)
  - 7 severe cases:
    - No improvement = 1
    - Corn recurrence = 3
    - (Other corns = 3)
  - 20/24 cases - slight or no lameness

Complications S+DDFT at P1

- **Minor**
  - Haemorrhage
  - Infection

- **Major**
  - Hyperextension P1/2
    - P1/2 arthrodesis/ankylosis
  - Tendon rejoining
    - revision

Full tenotomy digits 3 and 4

- Disaster!
  - Concussive pain palmar skin!
  - Corns on outer toes!

Complications
SDF tenotomy (ectomy)

- **Minor**
  - Haemorrhage
  - Infection

- **Major**
  - No improvement
    - Wrong diagnosis
  - Corn recurrence
    - Tendon rejoining

  - Changed to tendonectomy
    - Removal of 1cm of tendon

Tendon rejoined
diagnosis

- Palpation of tendon with the digits in forced extension

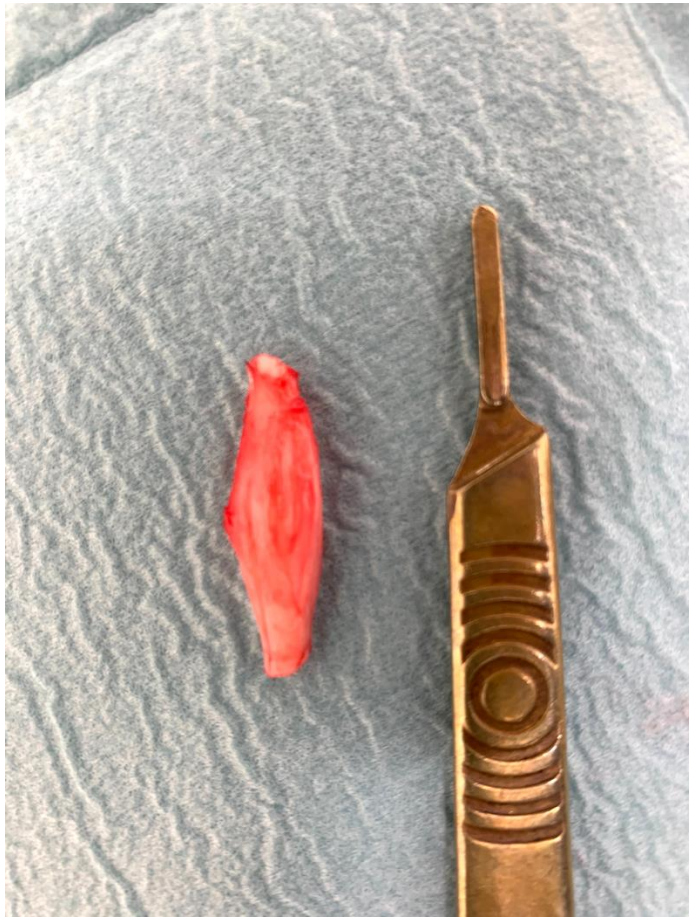
Tendon rejoined
diagnosis

- PIP joint (knuckle) returned to its original height/angle
  - Compare to adjacent toes
- MOST do rejoin
  - It needs to contract for another corn to form

Revision surgery

64 dogs
71 corns

- **For:**
  - Failed initial surgery (9 dogs 10 corns)
    - Check diagnosis
      - corn on another digit!
      - Another problem; bone tumour!
  - Tendon rejoining

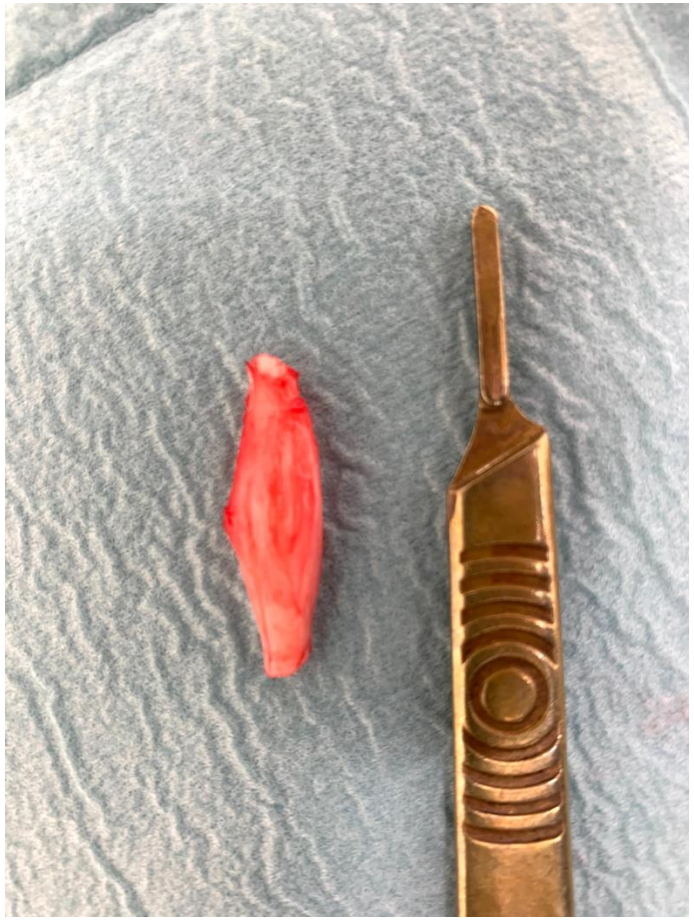


Revision surgery

64 dogs
71 corns

- **Time from initial surgery:-**
  - 3 months to 30 months
  - Average 11 months

- **Success rate after 12 months:**
  - 22 out of 27 corns no lameness (80% plus)



Revision surgery: 64 dogs with 71 corns

- **Initial surgery** (n = 71 corns)
  - SDF tenotomy (n = 20)
  - SDF tendonectomy (n = 47)
  - S & DDF tenotomy at P1 (n = 4)

- **Revision revision surgeries** (n = 8)
  - SDF tendonectomy revisions (n = 3)
  - S/DDFT tenotomy at MC revision (n=1)
  - P1 revision (n = 4)

Revision surgery: 64 dogs with 71 corns

- **Revision surgery sites**
  - S & DDF tendonectomy at metacarpus/tarsus
  - SDF tendonectomy at metacarpus/tarsus

Revision surgery: 64 dogs with 71 corns

- **Revision surgery sites**
  - S & DDF tenotomy at P1
- **Site selection:**
  - Avoid previous scarring/fibrosis
  - **If in doubt - S & DDF tenotomy at P1**

Frequently asked questions

- Can more than one corn have the surgery in one session?
    - Yes, ALL corns in one surgical session
- What is largest number of corns seen?
    - 7 digital pads. 3 surgical sessions
    - May develop tender feet on rough ground

Will tendon surgery increase the risk of more corns on that foot?

- 305 dogs with 508 corns
  - 128 had multiple corns
- 42% (128/305) had or developed multiple corns
  - 30% at presentation
  - 17% developed further corns
- Dogs presented initially with single corn:

  Recurrence in same foot = 5 dogs (13.5%)

  Recurrence in different feet = 22 dogs
- Random expectation is 25%
- **No** indication that tendon surgery increases the risk in the same foot.

Take home points

- Superficial digital tenotomy/ectomy and combined (S+DDFT) tenotomy give comparable results

- Primary treatment:
  - SDF tendonectomy

- Revisions
  - Combined tenotomy at P1 (cut all the bundles)

Complicated cases!!

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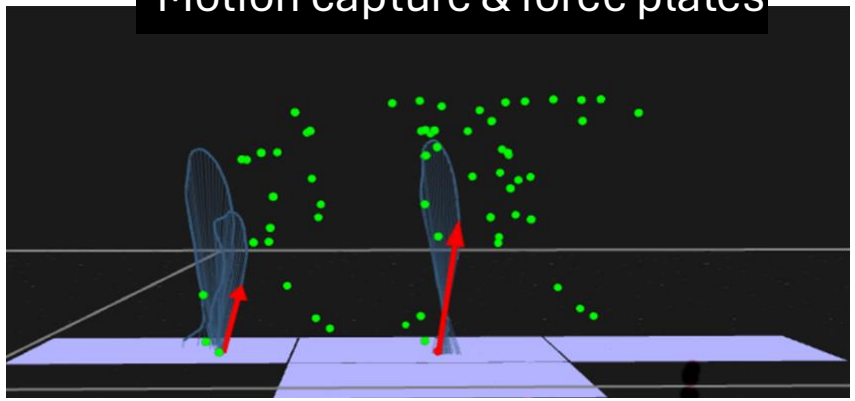
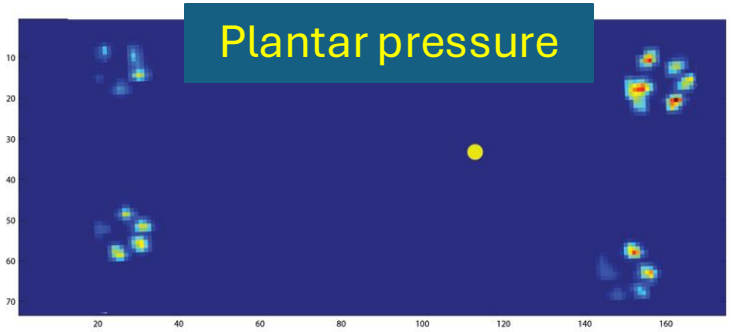
Evolutionary Morphology & Biomechanics

An integrated experimental-computational study assessing long term biomechanical effects of superficial flexor tendonectomy for corn treatment in greyhounds

Motion capture & force plates

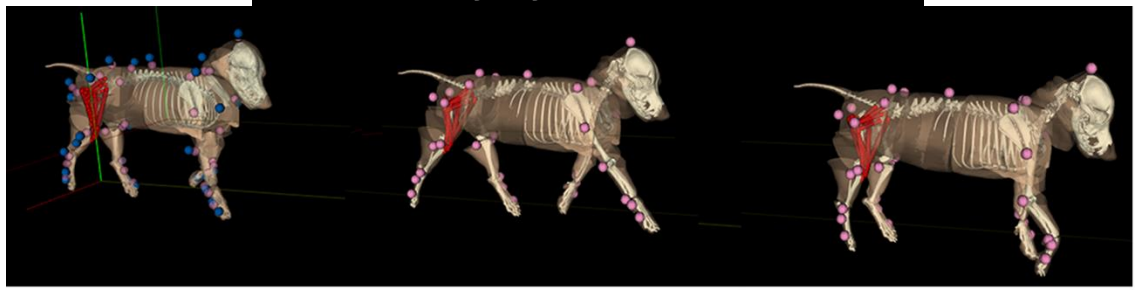


Plantar pressure



Bi-planar x-ray videography

Multi-body dynamics simulation



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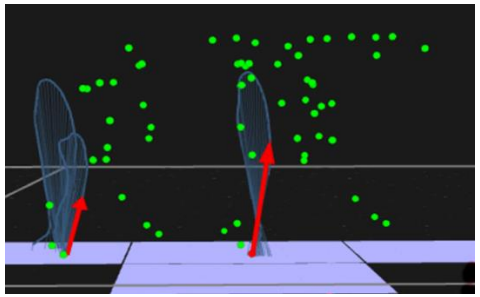
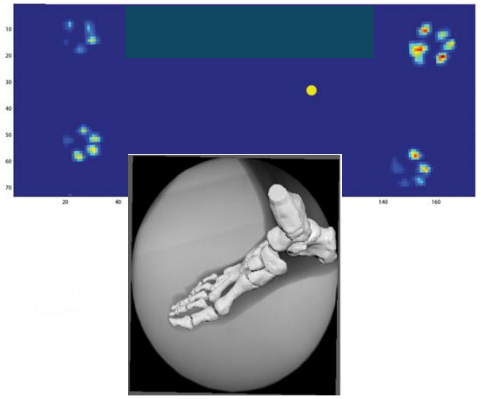
Evolutionary Morphology & Biomechanics

PhD Project Plan

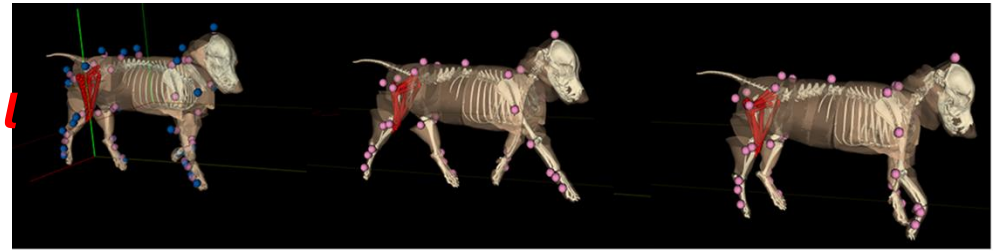
METHODS

Phase 1 - Experimental





Phase 2 - Computational



TIMELINE

Month1

Month6

Month12

Month24

EXPERIMENTAL COHORTS

Control (healthy) Group

Corn/tendonectomy Group – Pre-Surgery

6 months Post-Surgery

12 months Post-Surgery

24 months Post-Surgery

Control (healthy) Group

PhD Project

- Selection
  - 9 healthy control group
    - 6 GHs and 3 whippets
  - 9 post surgical dogs
    - 8 GHs (1 presurgical) and 1 whippet
  - Age range 1 to 8 years
- Apparatus
  - 3 D whole body capture
    - Motion of joints
  - Force plate
    - Ground reaction forces standing and walking
  - Pressure mat
    - Ground reaction forces trotting

PhD project
post operative questionnaires

- Time to become lameness free
  - 1 week - 3 dogs
  - 2 to 4 weeks – 5 dogs
  - 4 to 12 weeks – 1 dog
- After 1 year follow up
  - No lameness – 8 dogs
  - Slight lameness – 1dog

- Pain response (score 0 to 10)
  - Control group score 0
  - Post surgery group
    - 8 dogs scored 0
    - 1 dog scored 1